DOCUMENT RESUME

ED 319 628 SE 051 444

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TITLE Accountability in Mathematics Education. ERIC/SMEAC Mathematics Digest No. 3, 1988.
INSTITUTION ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
REPORT NO EDO-SE-88-7
PUB DATE 88
CONTRACT RI88062006
NOTE 4p.
AVAILABLE FROM ERIC/SMEAC, The Ohio State University, 1200 Chambers Road, Room 310, Columbus, OH 43212 ($1.00 single copy; ordered in sets by year and area $3.00).
PUB TYPE Reports - Descriptive (141) -- Information Analyses - ERIC Information Analysis Products (071)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Accountability; *Elementary School Mathematics; Elementary Secondary Education; Evaluation Criteria; Mathematics Achievement; *Mathematics Curriculum; Mathematics Education; *Mathematics Instruction; Outcomes of Education; Performance; *Program Effectiveness; School Effectiveness; *Secondary School Mathematics

ABSTRACT

This digest provides information on determining the effectiveness of school mathematics programs. The purposes for developing accountability programs and characteristics of good mathematics programs are listed. State goals and objectives and standards developed by the National Council of Teachers of Mathematics have furthered the production of materials useful in the development of school goals and objectives. Data on several variables should be collected, including curriculum, instruction, and student learning, to determine the effectiveness of the program. Processes for using collected data are considered. Thirteen references are listed. (YP)

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ACCOUNTABILITY IN MATHEMATICS EDUCATION

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ACCOUNTABILITY IN MATHEMATICS EDUCATION

Why are there more demands for accountability programs?

Participation and achievement in mathematics education in the United States have not been satisfactory. Fewer than 50 percent of the students in high schools take more than one mathematics course unless more courses are required. There has been little improvement in the averages of total American samples on the Scholastic Aptitude Test (SAT) and the National Assessment of Educational Progress (NAEP) tests. American students scored substantially below students from several other industrialized countries on the Second International Mathematics Study (SIMS) tests.

Business and industry reports and remedial courses in mathematics at the postsecondary levels of education provide further evidence that many students do not develop satisfactory knowledge and skills for using mathematics.

As a result of these reports and other data, parents, school staff, local school boards, state legislators, governors, and business and industry are calling for higher student achievement and changes in school mathematics programs. More assessment, different forms of assessment, and accountability programs at local, state, and national levels are also recommended to guide program improvement, lead to improved achievement, and identify variables that relate to effective programs.

What are the purposes and characteristics of a good school mathematics accountability and improvement program?

Accountability and improvement programs are designed, developed and used for several purposes. These include: (1) determining the planned curriculum; (2) determining what curriculum is used; (3) determining how teachers teach; (4) determining the impact of the curriculum and instruction on student achievement, attitudes, and behavior for all students and samples of students; (5) determining school, curriculum, teacher and student variables related to student achievement attitudes and behavior; (6) communicating accountability results to school personnel, parents, students, and others; (7) determining changes desired to improve achievement, attitudes, and behaviors, and; (8) changing policies, resources, and practices to help effect change.

A good mathematics accountability and improvement program should (1) develop a process that involves teachers, administrators, parents, students and other citizens; (2) establish desirable goals and objectives for the mathematics program; (3) select indicators to determine alignment of the curriculum, curriculum and instructional resources, instruction and instructional climate, program expectations and support, and student achievement and participation; (4) provide a process for analyzing the data obtained to determine achievement and participation levels and to identify variables related to program successes and weaknesses; (5) communicate results to the school and public; (6) determine changes desired; (7) establish policies, procedures, and practices to implement the changes; (8) continuously monitor the program, and; (9) provide mechanisms to reward success.

These procedures will provide information to help students, help improve the program, and communicate program activity and effectiveness to the school and public.

What materials are available to assist schools in determining desired goals and objectives?

Several states have developed state goals and objectives for mathematics to help schools determine their goals and objectives. California, Hawaii, Michigan, and others have delineated their goals and objectives and have produced documents that can provide guidance to others.

The National Council of Teachers of Mathematics (NCTM) has produced a series of standards that identify student achievement, attitudes, and behaviors desired and content and experiences to be included in a good mathematics program. The NCTM Standards recommend stressing (1) mathematical power, (2) problem solving, (3) communication, (4) reasoning, (5) mathematical concepts, (6) mathematical procedures, and (7) mathematical disposition. The NCTM Standards provide a detailed explanation of what is included in each of these categories.

The Council of Chief State School Officers convened a group to recommend what abilities and content should be included in the fifth National Assessment of Education Progress (NAEP) Assessment of Mathematics. The group considered the NCTM Standards, previous NAEP tests, and state goals and objectives.

The group recommended that three mathematical abilities be assessed: conceptual understanding, procedural knowledge, and problem solving. Content to be assessed includes: number operations; measurement; geometry; data analysis, statistics, and probability; and algebra and functions.

The group also recommended emphases for each of the abilities and for each of the content categories for assessments at grades 4, 8, and 12.

What data should be collected related to curriculum and curriculum resources?

Analyses of several accountability models and the NCTM Standards suggest at least the following curricular items should be analyzed: goals, objectives, and mathematical content; relative emphases of various topics and processes and their relationships; assigned time; articulation across grades; and availability of technological tools and support materials. Data on these

variables will provide an indication of the planned curriculum and materials and resources provided to achieve its goals and objectives.

What data should be collected related to instruction and the instructional environment?

Analyses of several accountability models and the NCTM Standards suggest at least the following items related to instruction and the instructional environment should be analyzed: mathematical content and its treatment; relative emphases assigned to various topics and processes and the relationship among them; opportunity to learn; instructional resources; classroom climate; assessment methods and instruments used; and articulation of instruction across grades.

What data on student learning and participation should be collected?

Data collected related to student learning and participation should be aligned with the curriculum and instruction in terms of (1) goals, objectives, and content, and (2) relative emphasis on topics and processes and their relationships.

Data on student learning should be collected from a variety of sources. The NCTM Standards recommend including data from tasks that are aligned to the curriculum, demand different kinds of mathematical thinking and present the same mathematical concept or procedure in different contexts, formats, and problem situations. The assessment methods and instruments selected should consider the type of information sought, the probable use of the information, and the development and maturity of the student.

This evaluation will require different forms of assessment instruments and procedures than those normally used. Schools should use instruments that assess their goals and objectives, as well as state or national goals and objectives, or they will not know how well their programs are functioning. Assessment procedures also need to emphasize performance and higher order objectives of the mathematics curricula.

Data should also be collected to measure courses students take, extra-curricular activities and mathematical experiences.

What processes and procedures should be established for using the data?

The goal of a mathematics accountability and improvement program is to provide a more effective mathematics program to improve student achievement, attitudes, and behaviors.

In most schools a climate needs to be established that supports planning, data use, and program modification (developing policies, practices, and resource allocations) based on data. This requires administrative support and commitment, involvement of important constituent groups, an action system and resources for change, and technical expertise and support. Research on change indicates that change occurs most frequently and with more effectiveness when there is regular participation of the principal and the teaching staff in reviewing and using the data, meetings focused on practices to be maintained or modified, regular communication of activities and progress, development of local materials to use in the program, assistance for teachers when needed, opportunity to observe effective programs/teachers, and credit or visibility for progress.

If schools are to have community support, there also needs to be community involvement and regular communication with the community. The community needs to understand and share the vision of the mathematics program. Representatives of the community should be involved in recommending goals and objectives, analyzing data, and recommending changes in policies and practice.

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This digest was funded by the Office of Educational Research and Improvement, U.S. Department of Education under contract no. RI-88062006. Opinions expressed in this digest do not necessarily reflect the positions or policies of OERI or the Department of Education.